



Legal terms and framework for the development of bioenergy and especially biogas in Germany



Prof. Dr.-Ing. Frank Scholwin

Weimar – December 2009

Deutsches BiomasseForschungsZentrum gemeinnützige GmbH, Torgauer Str. 116, D-04347 Leipzig, www.dbfz.de



Who am I, Frank Scholwin?



- First years at the coast line
- Skilled worker for electronics '92
- Study University of Rostock – Environmental Engineer '99
- PhD Rostock University and Bauhaus University Weimar '04
- Institute for Energy and Environment Leipzig
- German BiomassResearchCentre
→ 2008 founded
- University of Rostock since '09



  **Agenda** 

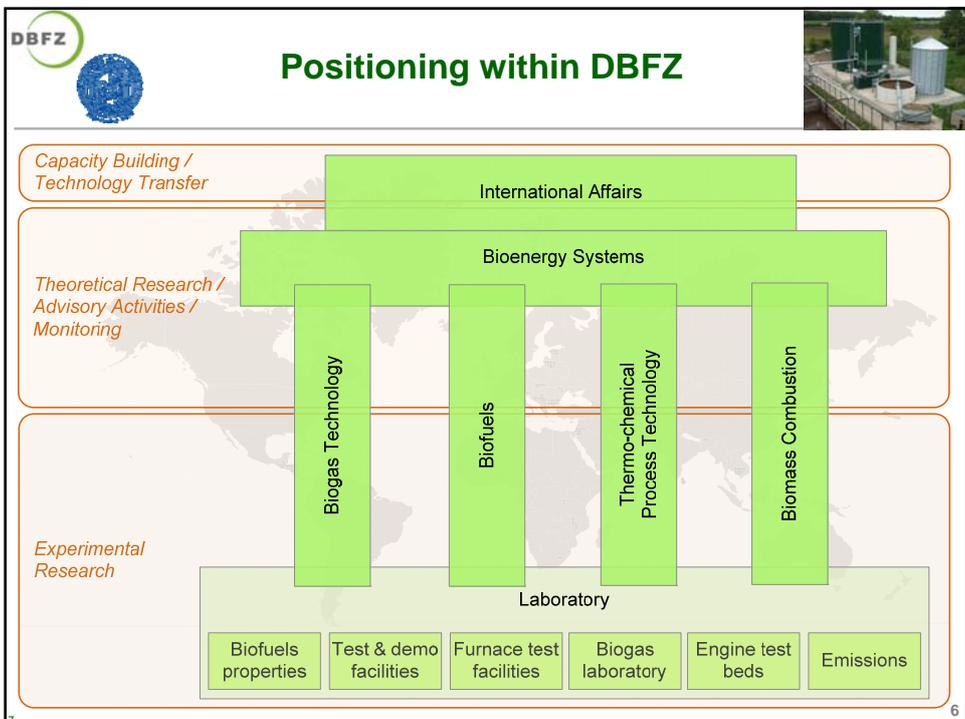
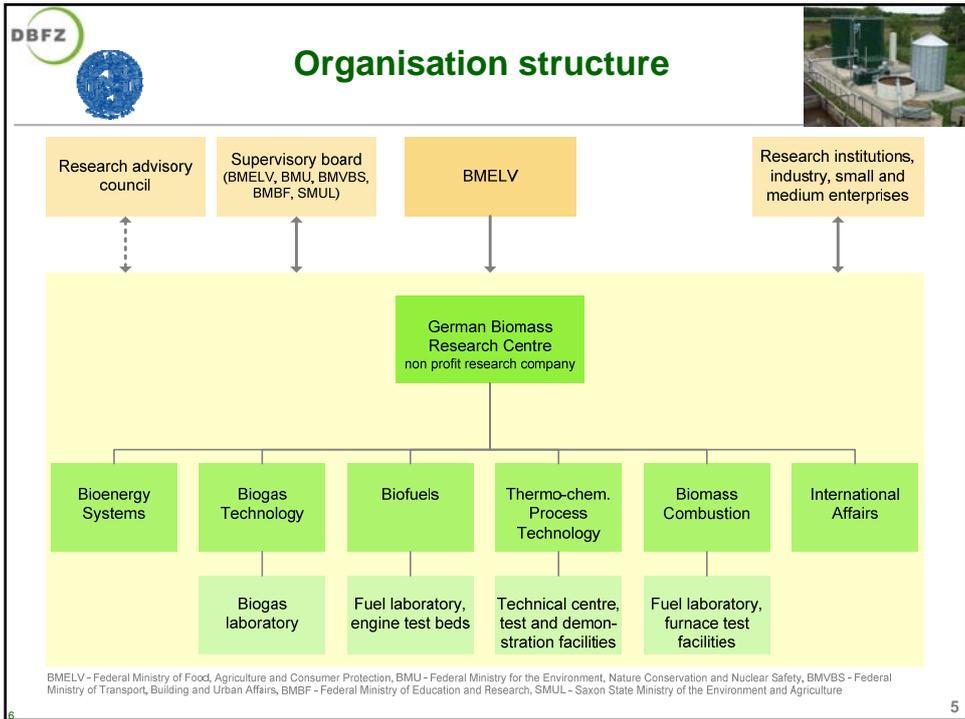
1. DBFZ at a glance
2. Background
3. Global framework
4. German framework

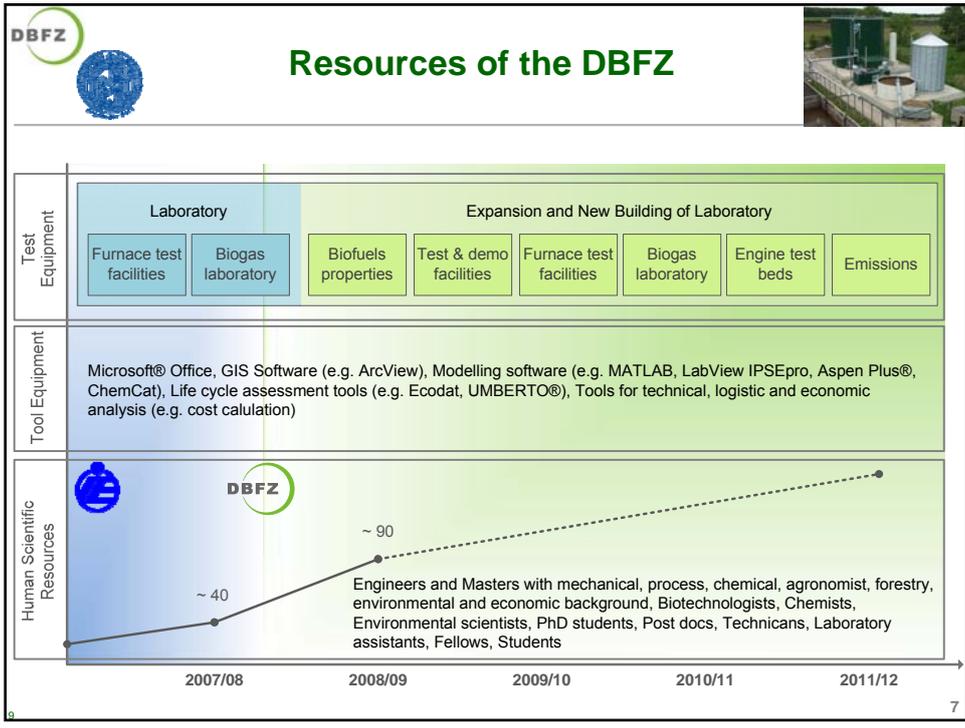
3

  **DBFZ
Goals and Tasks** 

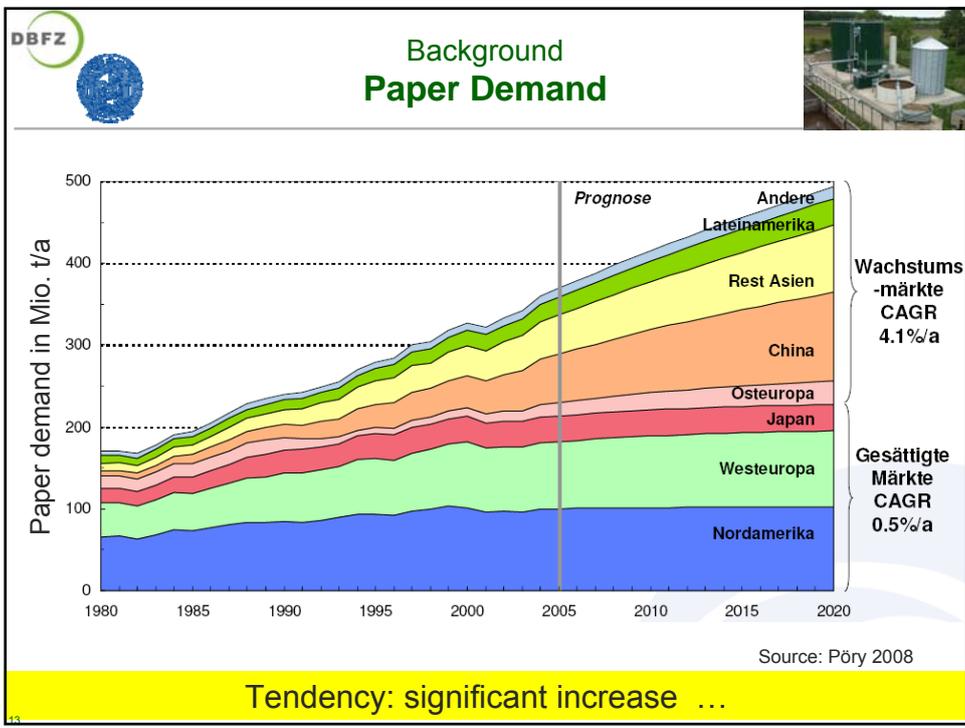
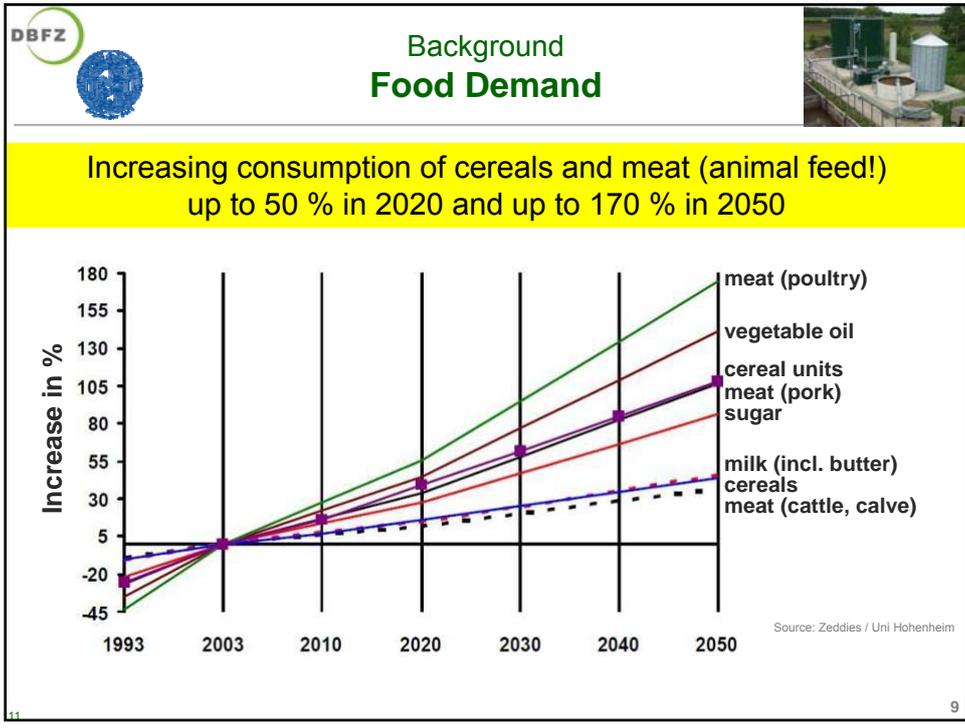
- Technical, economic and environmental research and development in the field of solid, liquid and gaseous biofuels
- Testing and certification of solid and liquid biofuels as well as conversion plants for the provision of heat, electricity and/or transportation fuels
- Support of private and public institutions concerning all questions related to "Biomass for Energy"
- Market assessment and data provision in the field of "Biomass and Bioenergy"
- Contributions to national and international committees e.g. for the development of standards and guidelines
- Support of Federal Ministries concerning strategic questions in the field of "Biomass and Bioenergy"
- Networking between the relevant national and international players

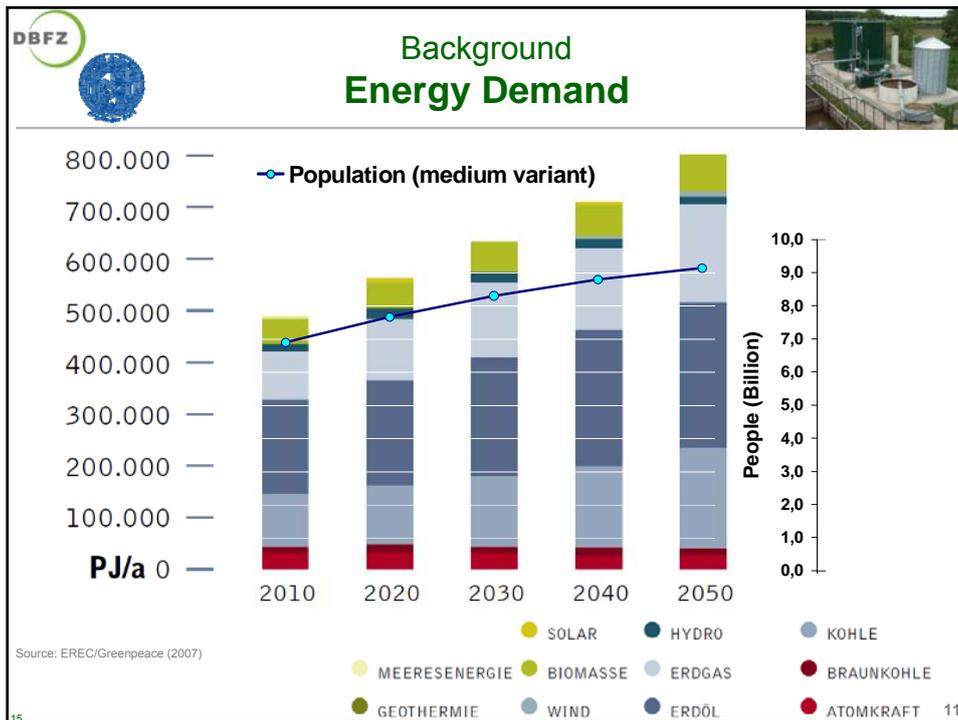
4





BACKGROUND





- DBFZ**
- ## Background Intermediate Conclusions
- The global demand for biomass will increase in the years to come – this will be true for the use as food and fodder, as a raw material as well as an energy carrier.
 - At the same time the expansion of the feedstock basis is getting more and more difficult:
 - The available land area is limited
 - The area specific yield of agricultural plants can only be increased by a certain amount
 - The same is basically true for wood from the forest
 - Therefore the need to use the limited amount of biomass more efficiently is increasing in the years to come; and this is true from a technical, economic, environmental and social point of view.
 - Out of this "NEED FOR EFFICIENCY" numerous research challenges are resulting
 - The biomass share is today at 10 %; this share will grow absolutely and relatively in the future under the actual framework
 - **Therefore it is from global point of view not the question if biomass should be used intensified – it is more the question what measures will frame biomass utilization in a way that biomass will be used globally, regionally and locally sustainable.**



Question



Why biomass and biogas should be used and forced as energy source ?

What are differences between Germany and Thailand?



Why should one force the bioenergy sector?



Fulfilling of environmental aims (e.g. Kyoto)

Recycling of organic matter (carbon and nutrients)

Improvement of security and sustainability as well as regional availability of energy supply

Bioenergy production is often not competitive today.



GLOBAL FRAMEWORK



Question



What framework conditions and mechanisms Do you know for Biogas production and biogas utilisation?



Example: European Union



Challenges:

- Available energy grids almost everywhere
- Well operating energy supply
- Well developed environmental policy

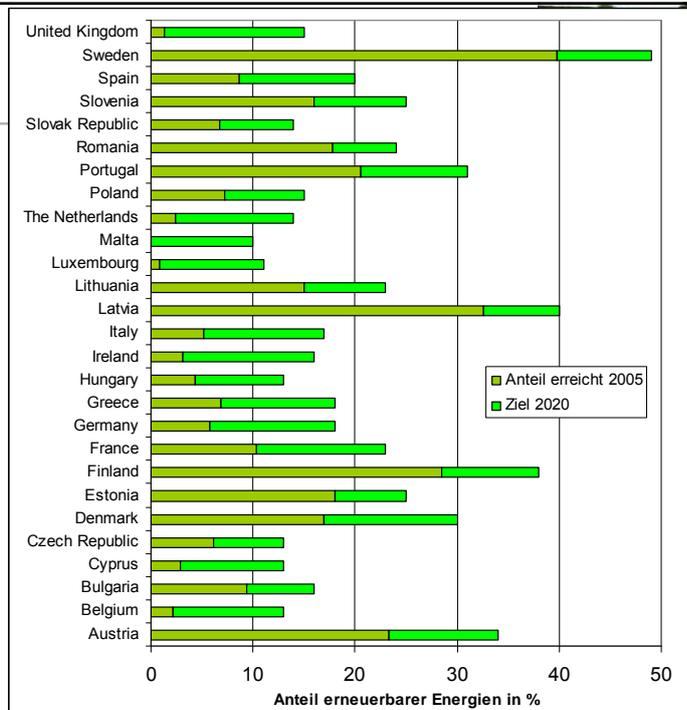
- 2008: clear targets for greenhouse gas emission reductions
 - 2020: in average 20 % of energy supply from renewables
 - National targets depend on national status and abilities as well as traditions
 - Nations are free to decide about the kind of renewables (Biomass, Wind, Water, Solar)
 - Pathway: 25 % of targets in 2011/2012
 - 35 % 2013/2014;
 - 45 % 2015/2016;
 - 65 % 2017/2018.

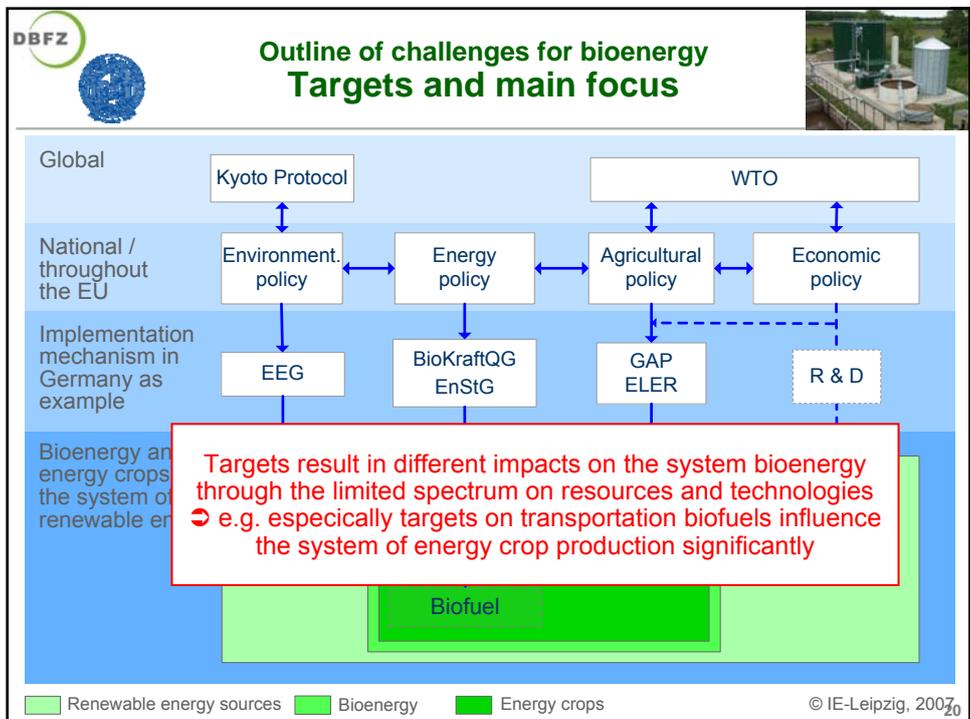
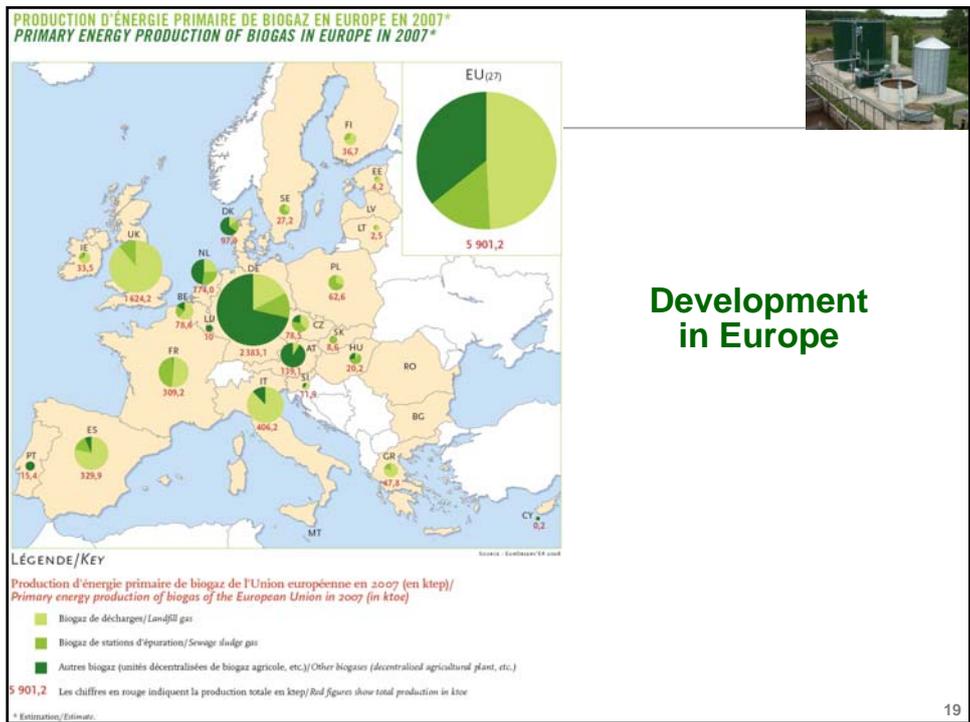
17



Example: European Union

2002 achieved and 2020 targets in % share of energy demand







Kyoto Mechanisms



- Contract countries will reduce greenhouse gas emissions between 2008 and 2012 with 5,2 % under the level of 1990
- National targets depend on economic state of country (e.g. EU: 8 %)
- 2008: 183 full member states under the contract
- Main instrument: CO₂-certificates trading
 - Good experiences in the biogas sector
 - Lots of international demonstration plants realised (waste, agriculture, wastewater, landfill)
 - Certificate price market dependent (do not calculate with more than 10 €/t)
 - Guidelines for application: UNFCCC – rules are clear
 - Advantages: Biogas in warm climates
 - Essential:
 - Application of mechanisms in the country where the activity will be carried out
 - Active application procedures under realisation
 - Combination with tariff systems (e.g. Germany) regularly not possible
 - Framework reliable until 2013 only

21



Biofuels policies



- International enforcement: Biofuels application
- Example EU: 2020: 10 % of all fuels are fuels from biomass
- Biomethane from biogas will support this development
- Realisation depends on national policy and instruments



22



Unbundling of energy grids



- Unbundling internationally under progress
- Separation of Energy transportation and energy trading
- Leads to access rules for energy grids (Electricity, Gas)
- Basis for Biogas as an energy resource (power Plant)
- Grid access is the essential basis for implementation of bioenergy into energy system – starting with selling biogas to the neighbour

23

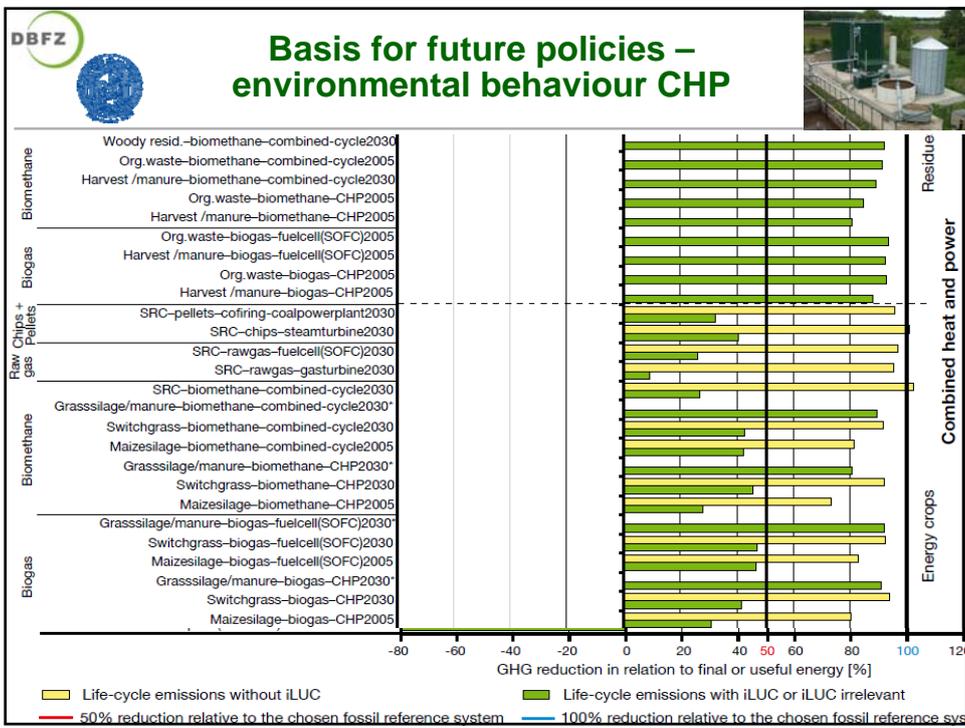
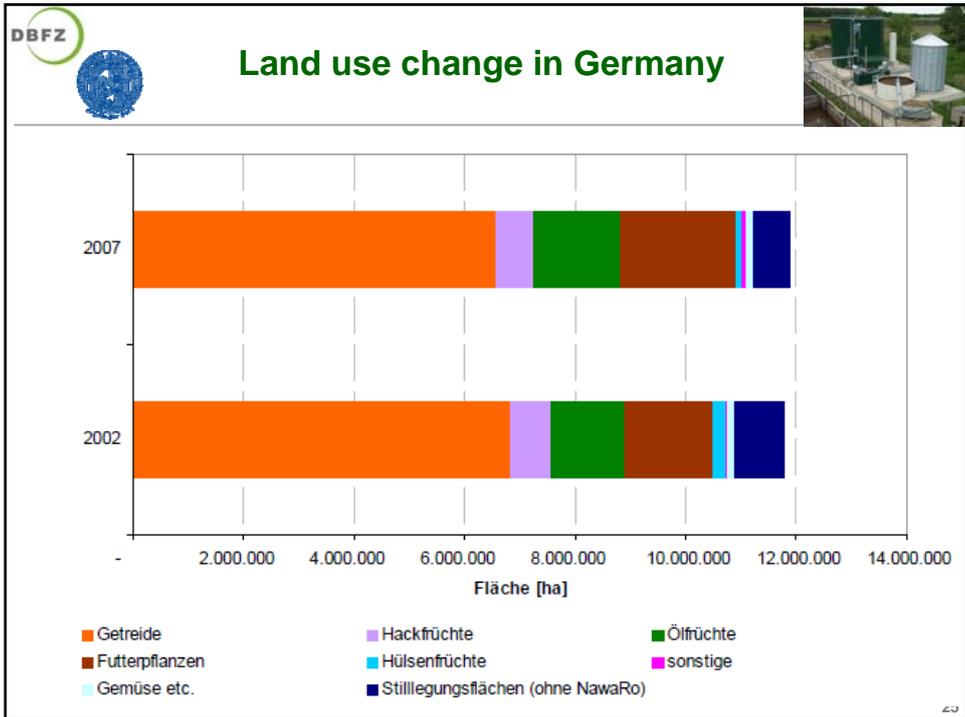


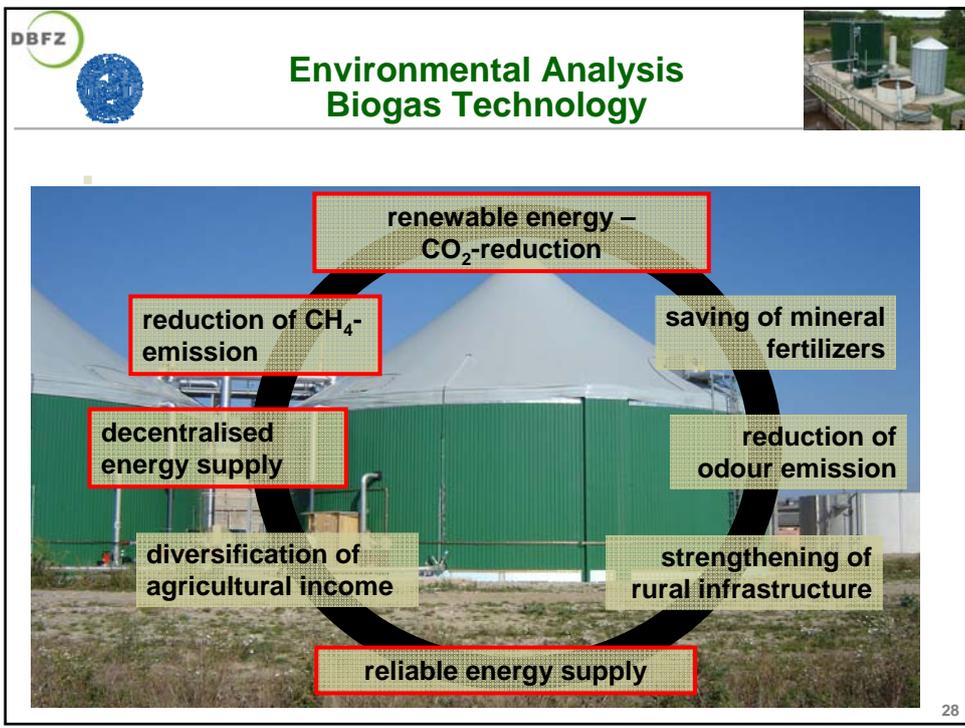
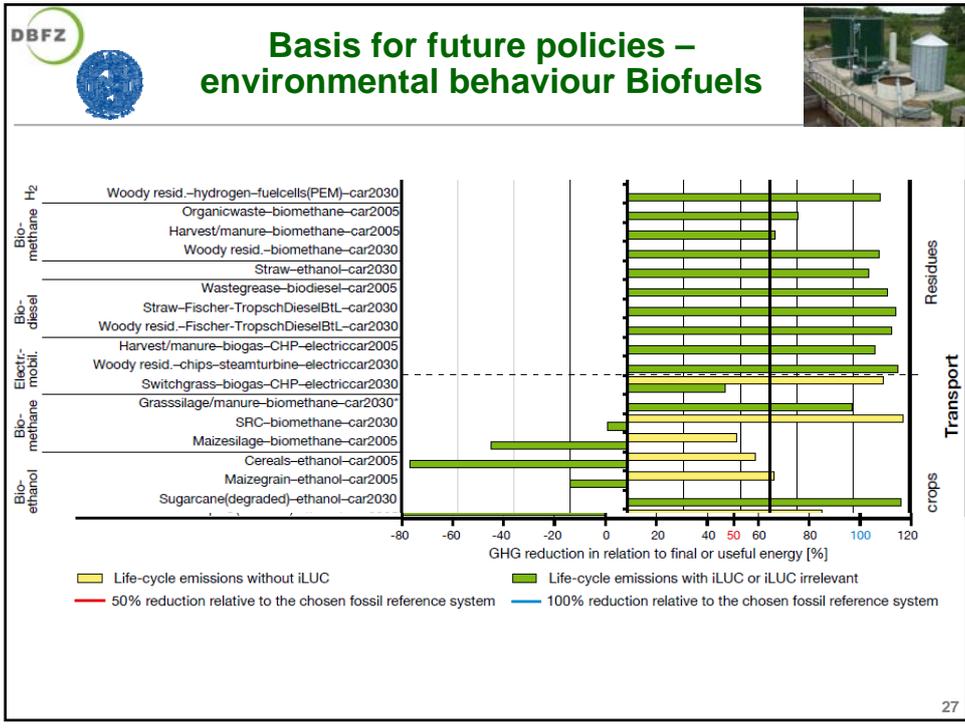
Competition on biomass resources



- Waste:
 - Competition on energetical use is still running
 - Energetical use has mainly positive effects
 - Environmental improvement from storage / landfilling
 - Recirculation of nutrients and carbon/humus
 - Supply of renewable energy
 - Supply of decentralised energy
- Energy crops:
 - Competition between food and energetical use starts world wide
 - Land use changes occur e.g. wetlands
 - Regional effects of large scale bioenergy applications
 - Broader crop production systems (biodiversity of crop cultures)
 - Raising fertilizer (P) demand
 - Wood production on agricultural land
 - Supply of renewable energy with positive greenhouse effects

24







GERMAN FRAMEWORK



Question



What German framework conditions and mechanisms Do you know for Biogas production and biogas utilisation?



Political targets and incentives – Germany (1)



- Climate protection package:
 - 14 laws and more measures (e.g. EEG, requirements for energy efficiency in buildings – 30 % energy savings, investment funding for energy efficiency and renewables in electricity, fuel and heat sector, 3.3 billion € 2008; increased efficiency in (gas)-CHP and m.m.)

- Qualitative targets:
 - Climate protection – greenhouse gas reduction
 - Security of energy supply
 - Decrease of dependency on energy import
 - Sustainability of energy supply (biomass supply)

31



Political targets and incentives – Germany (2)



- Quantitative main targets:
 - 40 % greenhouse gas reduction 2020 (basis 1990)
 - Today 36 % seem to be realistic
 - 25-30 % electricity from renewables in 2020
 - 2008: 15 %; 6 years ago 6 %
 - 2007-2020: 60 mio t CO_{2eq} to be saved
 - 14 % Heat from renewables 2020 (2007: 6,6 %)
 - 17 % Biofuels in 2020 (2007: 6,9 %)
 - 10 % renewables share of primary energy production (2007: 6,6 %)

- German gas industry:
 - 10 % biomethane as CNG-fuel in 2010
 - 20 % biomethane as CNG-fuel in 2010



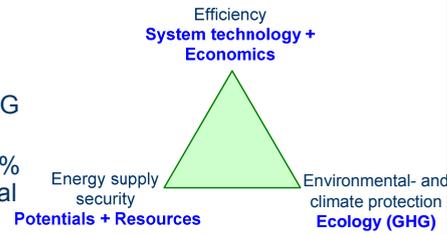


Biofuel targets



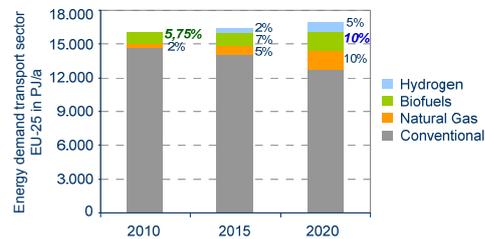
Energy policy targets

- Superior targets within the framework of sustainability
- Target within Biofuels directive 2003/03/EG and Roadmap COM(2006)848
- Commitment of gas suppliers (DE): 10/20% biomethane for transportation using natural gas in 2010/2020 (~ 2.8/11.2 PJ/a)



Technical targets on biofuels

- Production of biofuels that are
 - technical efficient
 - economic efficient
- Integration of biofuel production systems into regional existing biomass potentials
- Implementation of a reasonable mix under consideration of existing infrastructure of distribution and use



Biofuels Directive 2003/03/EG
Roadmap Renewable Energies COM(2006)848

33



Support mechanisms for Biogas production and utilization in Germany



- Forcing the use of biomass
 - Biomass Act
- Forcing Electricity supply
 - Renewable Energies Act
- Forcing Heat supply
 - Renewable Heat Act
 - Market Incentive Program
- Forcing biofuels supply
 - BioFuelsDirective / Biofuels Quota Act
 - Energy taxes Act
 - Commitment of Gas Suppliers
- Forcing biomethane injection into the national gas grid
 - Gas Entry Act / Energy Management Act
- Forcing biogas production generally

34



Biomass: Biomass Act



- Clear definitions on the sources of biomass what can be used for bioenergy supply
- Clear difference between grey waste and biomass

- **Stipulation of:**
 - substances to be regarded as biomass under the EEG
 - technical procedures used in the generation of electricity
 - environmental standards



35



Electricity: Renewable Energies Act (EEG)



- **The EEG**
 - Gives RE priority access to the electricity grid
 - Obliges grid operators to purchase the RE electricity
 - Fixes the price (tariff) for RE electricity

- 2000 / 2004 / 2009; effective instrument in electricity generation from RenEn
- Applies to: wind, solar, biomass, geothermic energy
- Feed-in tariff depends on plant-capacity/size, used technology and heat utilization
- The Renewable Energy Sources Act (EEG) was amended in 2008 based on the results of an evaluation report (2007)
- Guaranteed payments will range from 3,5 (huge hydropower) to 43,01 ct/kWh (small solar on buildings).
- An extra bonus is guaranteed for renewable raw materials (2,5-11 ct/kWhel) (biomass grown exclusively for energy use; use of residual and secondary products is allowable but is not subsidised) or combined-heat and power generation

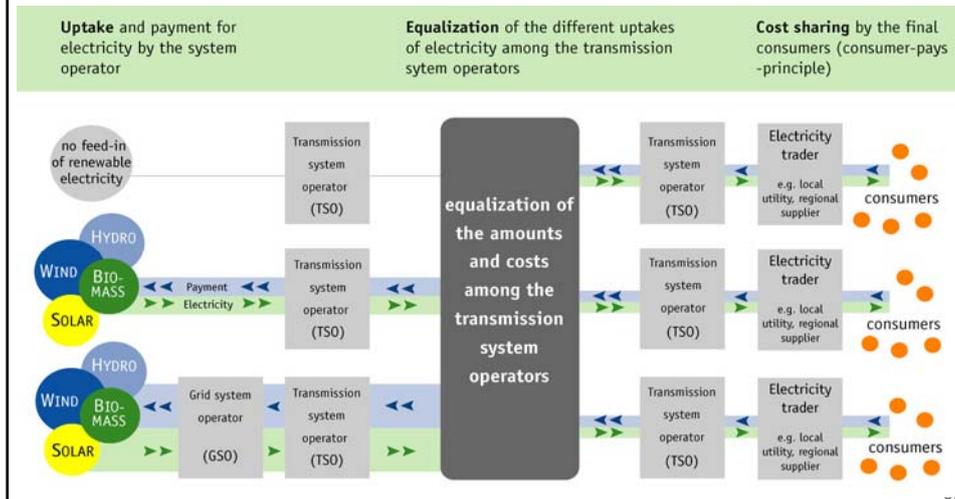
36



Electricity: Renewable Energies Act (EEG)



How the EEG act works cost sharing by the consumers



Electricity: Renewable Energies Act (EEG)



Why different tariffs?

- All types of RE are needed to reach the RE targets
- Cost for RE electricity depend on different factors, e.g. kind of RE and size of plant
- Consequences:
 - Tariffs need to be differentiated by source and plant size
 - Tariffs for new plants need to decrease every year to further technological development and to bring costs down
 - Tariffs have to be revised regularly



Electricity: Renewable Energies Act (EEG)



Guaranteed electricity feed in tariffs

- Planning guarantee: feed in conditions for 20 years
- Degression of tariffs and bonuses: 1 % p.a.
- Internal rate of return about 10 %

ct / kWh _{el}	Tariff composition						
	Basis tariff	Bonus, additive					
		Natural biomass		Manure > 30 %	Rural Conservation	CHP	Immission
Biogas	Others						
≤ 150 kW _{el}	11,67	+ 7,0	+ 6,0	+4,0	+2,0	+ 3,0	+ 1,0
≤ 500 kW _{el}	9,18	+ 7,0	+ 6,0	+1,0	+2,0	+ 3,0	+ 1,0
≤ 5 MW _{el}	8,25	+ 4,0	+ 4(2,5)			+ 3,0	
≤ 20 MW _{el}	7,79					+ 3,0	



Electricity: Renewable Energies Act (EEG)



Regulations for bonus system:

- All bonus schemes are additive
- CHP bonus: when on positive list **or** substitution of fossile fuels is realised **or** additional costs for heat use > 100 € / kW for investment
- Immission bonus: keep within limits of formaldehyde emissions
- Natural biomass (energy crops): only for electricity **share** from natural biomass and covered residues storage
- Innovation (additive): Fuel Cells, gas turbines, steam engines, ORC-processes, Kalina Cycle processes, Stirling engines, biowaste use with aftercomposting **and** electrical efficiency > 45 %: 2 ct/kWh up to 5 MW_{el} **or** gas upgradation < 350 Nm³/h 2 ct/kWh; < 700 Nm³/h 1 ct/kWh at < 0,5 % methane emissions and < 0,5 kWh / Nm³ electricity demand and renewable heat supply



Teamwork



Exemplary calculation of tariffs for biogas plants.

1200 kW_{el} from 10 % manure and 90 % energy crops

39

41



Calculation Example: Biogas Plant based on maize silage and manure



1,2 MweI CHP plant 7300 hours full load per year
 Average: 1200x(7300/8760) = 1000 kW_{el} electricity generation
 Heat use: 40 % of excess heat (without own demand) ca. 300 kW
 Calculation of tariff and income:

150 kW share 150x8760	1314000 kWh	basis tariff natural biomass CHP use emission Total tariff	11,67 ct/kWh 7,00 ct/kWh 1,20 ct/kWh 1,00 ct/kWh 20,87 ct/kWh	274.231,80 €	
150-500 kW share 350x8760	3066000 kWh	basis tariff natural biomass CHP use emission Total tariff	9,18 ct/kWh 7,00 ct/kWh 1,20 ct/kWh 1,00 ct/kWh 18,38 ct/kWh	563.530,80 €	average Tariff 16,29 ct/kWh
500-1000 kW share 500x8760	4380000 kWh	basis tariff natural biomass CHP use emission Total tariff	8,25 ct/kWh 4,00 ct/kWh 1,20 ct/kWh 0,00 ct/kWh 13,45 ct/kWh	589.110,00 €	
				1.426.872,60 €	
Additional income: Heat sales 3 ct/kWh:		78.840,00 €		1.505.712,60 €	
(Fertilizere sales):		45.000,00 €		1.550.712,60 €	
Main costs: Investment 4 Mio €:		300.000,00 €			
Maintenance and others:		170.000,00 €			
Energy demand:		105.000,00 €			
Substrates:		500.000,00 €			
Personnel:		120.000,00 €		1.195.000,00 €	

42




Calculation Example: Biogas Plant based on food residues and manure



1,2 MweI CHP plant 7300 hours full load per year
Average: 1200x(7300/8760) = 1000 kWel electricity generation
Heat use: 40 % of excess heat (without own demand) ca. 300 kW
Calculation of tariff and income:

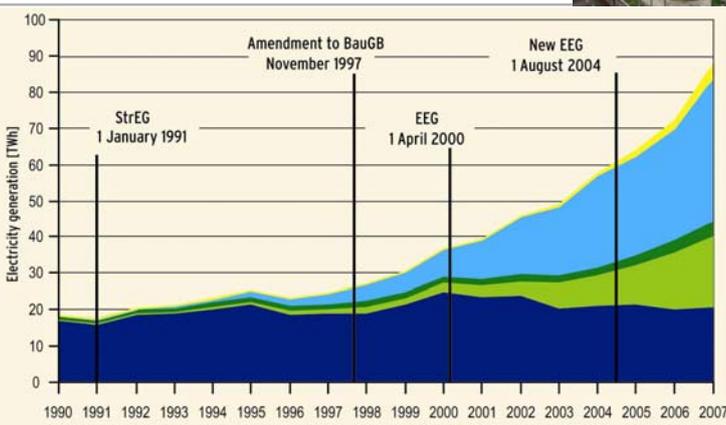
150 kW share 150x8760 1314000 kWh	basis tariff 11,67 ct/kWh natural biomass 0,00 ct/kWh CHP use 1,20 ct/kWh emission 1,00 ct/kWh Total tariff 13,87 ct/kWh			
150-500 kW share 350x8760 3066000 kWh	basis tariff 9,18 ct/kWh natural biomass 0,00 ct/kWh CHP use 1,20 ct/kWh emission 1,00 ct/kWh Total tariff 11,38 ct/kWh			average Tariff 10,79 ct/kWh
500-1000 kW share 500x8760 4380000 kWh	basis tariff 8,25 ct/kWh natural biomass 0,00 ct/kWh CHP use 1,20 ct/kWh emission 0,00 ct/kWh Total tariff 9,45 ct/kWh			
				182.251,80 €
				348.910,80 €
				413.910,00 € 945.072,60 €
Additional income: Heat sales 3 ct/kWh: 78.840,00 €				1.023.912,60 €
(Fertilizere sales): 45.000,00 €				1.068.912,60 €
Main costs: Investment 4 Mio €: 300.000,00 €				
Maintenance and others: 170.000,00 €				
Energy demand: 105.000,00 €				
Substrates: - €				
Personnel: 120.000,00 €				695.000,00 €




Development of RES sector in Germany

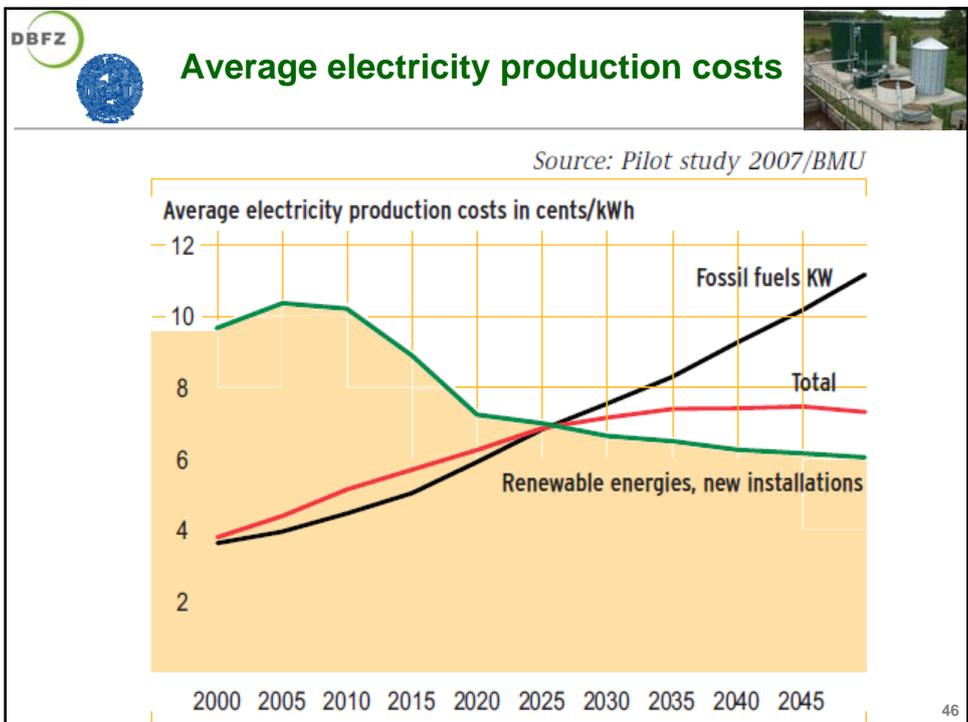
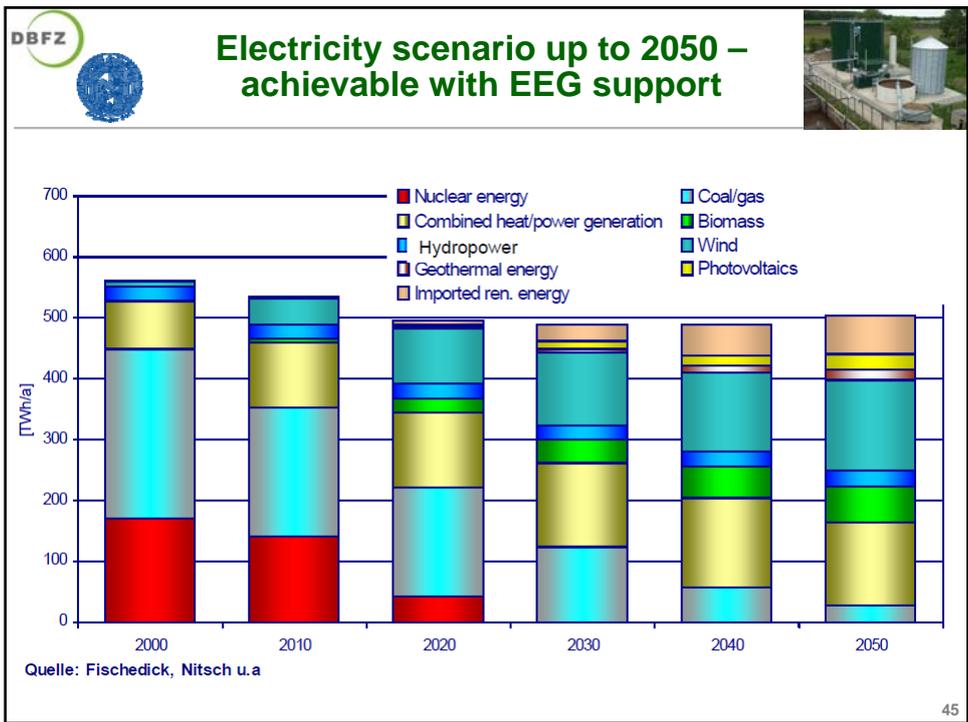


- Photovoltaics
- Wind energy
- Biogenic share of waste
- Biomass
- Hydropower



StrEG: Act on the Sale of Electricity to the Grid
BauGB: Construction Code
Geothermal electricity generation not shown, due to the negligible quantities of electricity produced

Source: BMU publication „Renewable energy sources in figures - national and international development“, Status: June 2008





Cost and Benefits of the EEG



Source: Engineering Agency for New Energy Sources IfnE/BMU

Cost effects of EEG-promoted electricity generation (estimated / 2006)

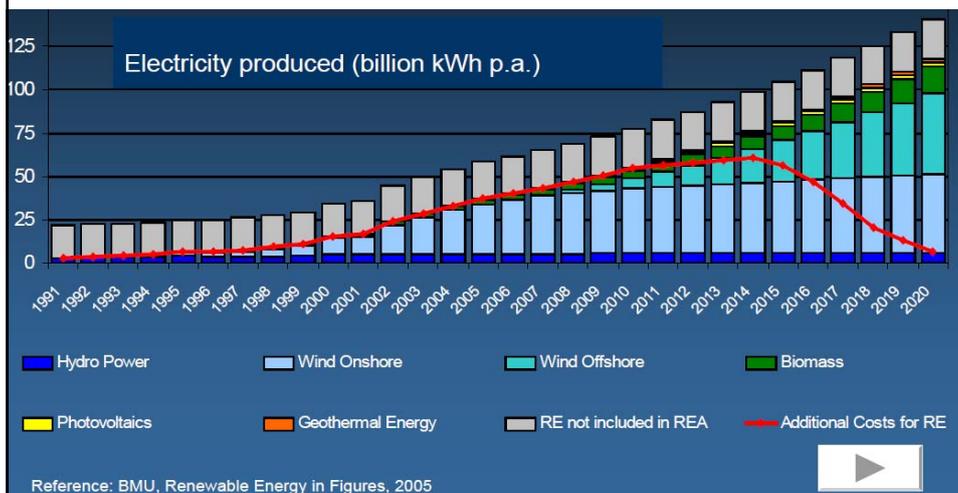
Benefit effects of EEG-promoted electricity generation (estimated / 2006)

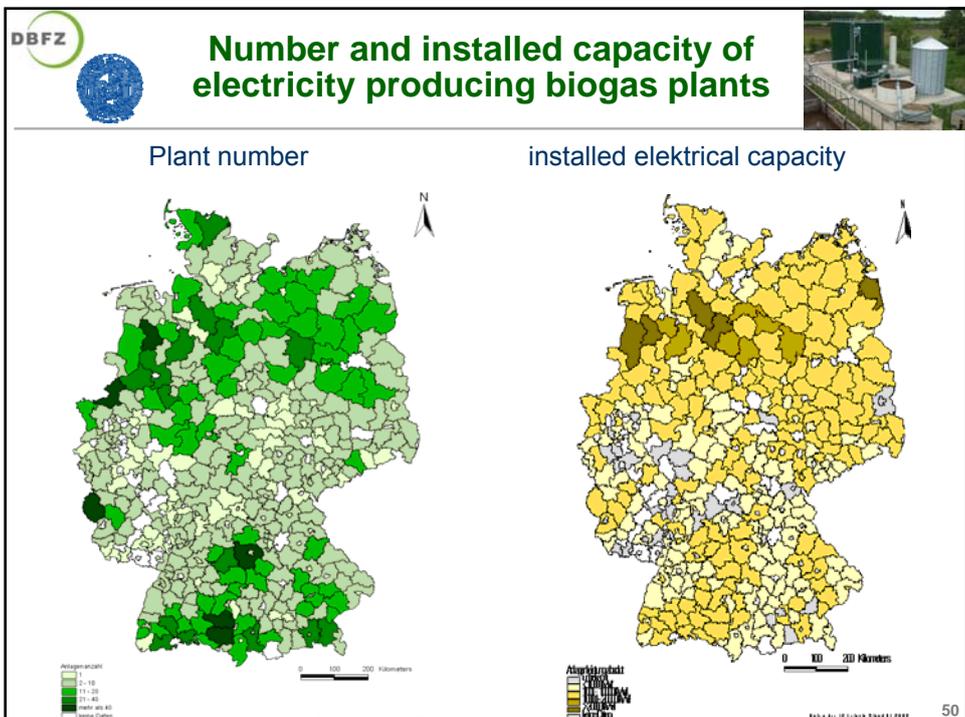
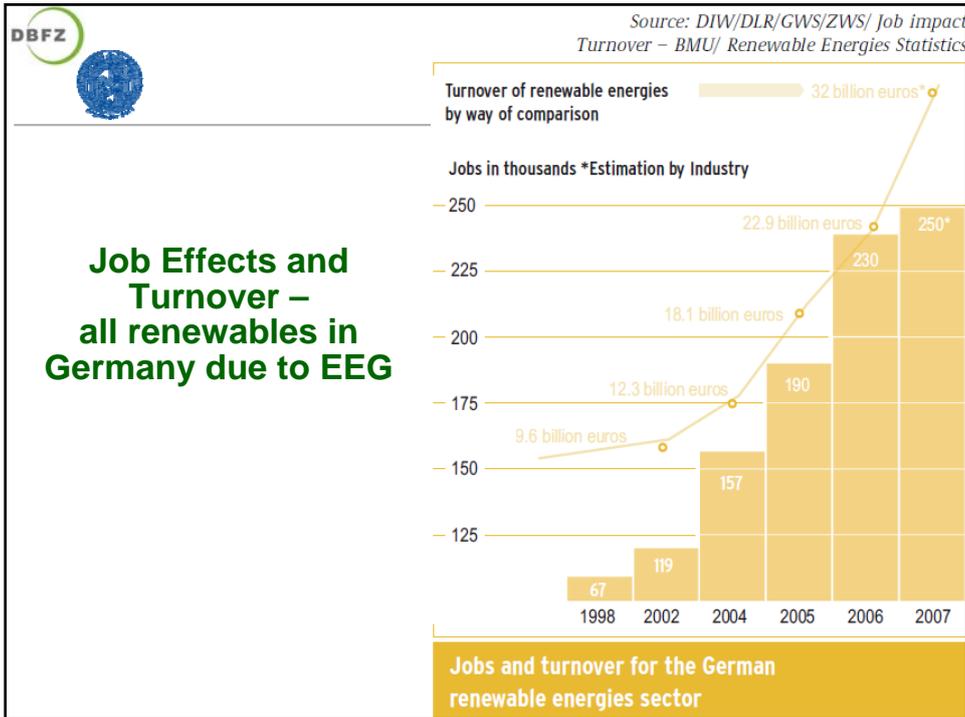
EEG differential costs Additional costs as compared with conventional electricity generation in accordance with Section 15 of the EEG.	3.2 billion euros	5.0 billion euros	Reduction in the wholesale price Price reduction through merit-order effect, i.e. EEG electricity crowding out electricity produced from fossil fuels
Additional costs, regulation energy Estimate of the upper limit, as no coherent information is available from the transmission system operators.	0.1 billion euros	3.4 billion euros	Avoided external costs for electricity generation External costs from climate change and air pollutants
Transaction costs Estimate of personnel costs, as no information is available from the grid operators.	0.002 billion euros	1.0 billion euros	Avoided energy imports Savings in hard coal and gas imports for electricity generation, including large-scale hydroelectric power plants.
= 3.3 billion euros		= 9.4 billion euros	

Cost and benefit effects of the EEG



Expected additional cost development







Conclusions from support schemes



- EU-Commission (2005):
 - „feed-in tariffs are currently in general cheaper and more effective than so called quota systems“, because
 - They give high planning and investment security
 - Involve lower risks for investors
 - Cause low transaction costs

- Success depends highly on details of regulation
 - Design carefully and properly!
 - Different tariffs
 - Sufficient payback periods
 - Administrative framework conditions, e.g. admission regulations, electricity grid capacity, priority feed in...

51



Heat: Renewable Heat Act and Market Incentive Program



- **Renewable Heat Act**
 - Obligation to use renewable energy in new buildings
 - As of 1 January 2009 owners of new buildings > 50 m² will be obliged to provide a minimum share of their heat demand with RES:
 - min. 15% with solar energy **or**
 - min. 30% with biogas district heating if provided by a CHP plant **or**
 - min. 50% with liquid biofuels when sustainability is certified **or**
 - min. 50% with biomass in high efficient systems **or**
 - min. 50% with heat pumps.

- **Market Incentive Program**
 - Subsidies for modern ovens for pellets / split logs
 - Subsidies for raw biogas grids and district heating grids
 - Investment grants for innovative bioenergy production plants / demonstration plants



52



Biofuels: Biofuels Directive, Biofuels Quota Act, Energy taxes Act



■ Biofuels Directive / Biofuels Quota Act

- Clear target quotas; biogas is one of the biofuels options
- Intention: Increasing share of biofuels to > 6,25% by 2015 (relating to energy content)
- Fuel selling enterprises are obligated to sell a minimum quota of biofuels; purchase at market conditions
- Biofuels are fully taxed within the quota
- Pure biofuels enjoy tax privileges until 2012
- E85 and the 2nd generation of biofuels enjoy tax exemption until 2015
- (pure as well as in blendings)
- Pure biofuels used in agriculture remain tax-exempt



Biofuel quota act



■ Biofuel Quota Act (Jan 2007)

- Introduction of biofuel quotas for:
 - Producers and traders of Diesel fuel and gasoline
 - Producers of biofuels (biodiesel, vegetable oils)
- Quotas related to energy content

Year	Total quota	Diesel quota	Petrol quota
2007	-	4,40	1,20
2008	-		2,00
2009	5,25		2,80
2010	6,25		3,60
2011	6,25		
2012	6,25		
2013	6,25		
2014	6,25		
2015	6,25		

54



Energy taxes Act



- **Until July 2006:**
 - **Compensation of cost disadvantages of biofuel production plus small incentive**

- **Since August 2006:**
 - **Avoiding overcompensation of fiscal support**
 - **Gradual increase of taxes for biodiesel and vegetable oil fuel**
 - **Adjustment of fiscal support of biofuels due to changes in**
 - **cost structures**

55



Energy taxes Act



- **Energy Tax Act (Aug 2006)**
 - **Since Aug 2006 taxation of pure biofuels**
 - **Tax exempted:**
 - **2nd generation until 2015**
 - **Biofuels used in agriculture and forestry**

Year	Tax rate biodiesel (Cents/l)	Tax rate vegetable oil (Cents/l)
2006	9	0
2007	9	2,15
2008	15	10
2009	18	18
2010	24	26
2011	30	33
From 2012	45	45

56



Biofuels: Industrial commitment

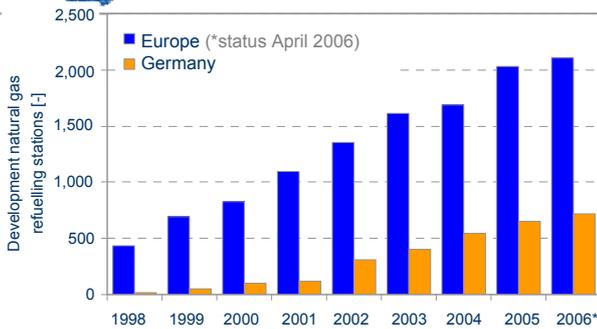


Commitment of Gas Suppliers

- 10/20% biomethane for transportation using natural gas in 2010/2020
- No governmental regulation
- Voluntary
- Market share of gaseous fuels will raise significantly

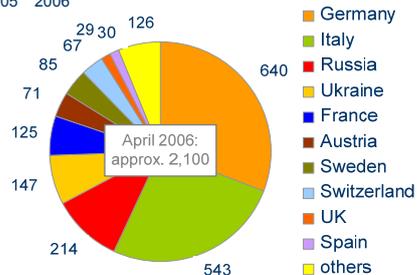


Present status of gaseous fuels in Europe and Germany

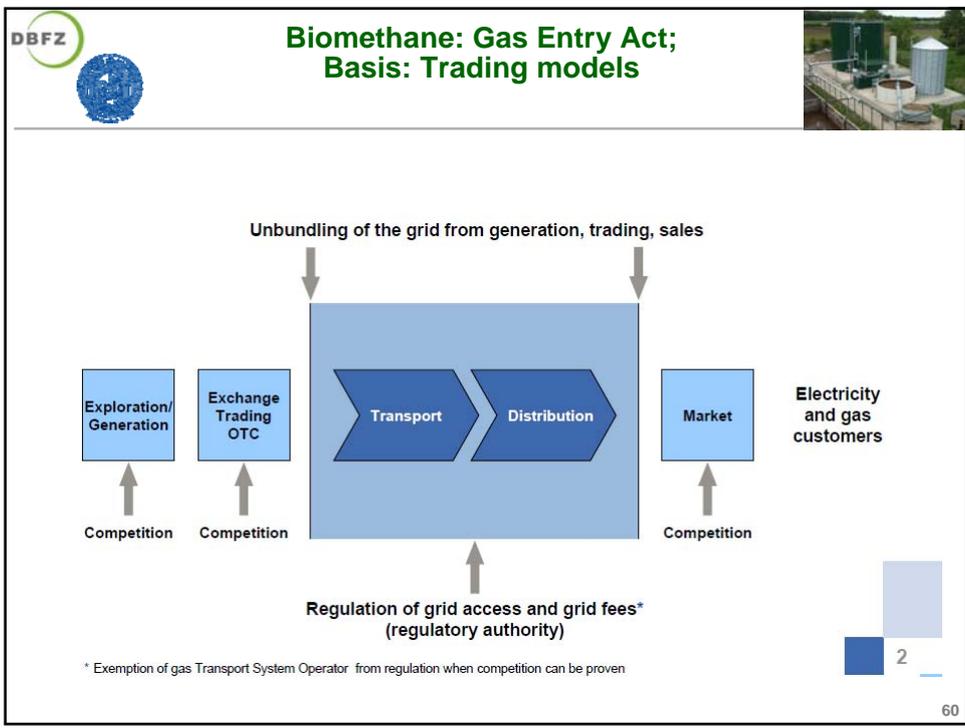
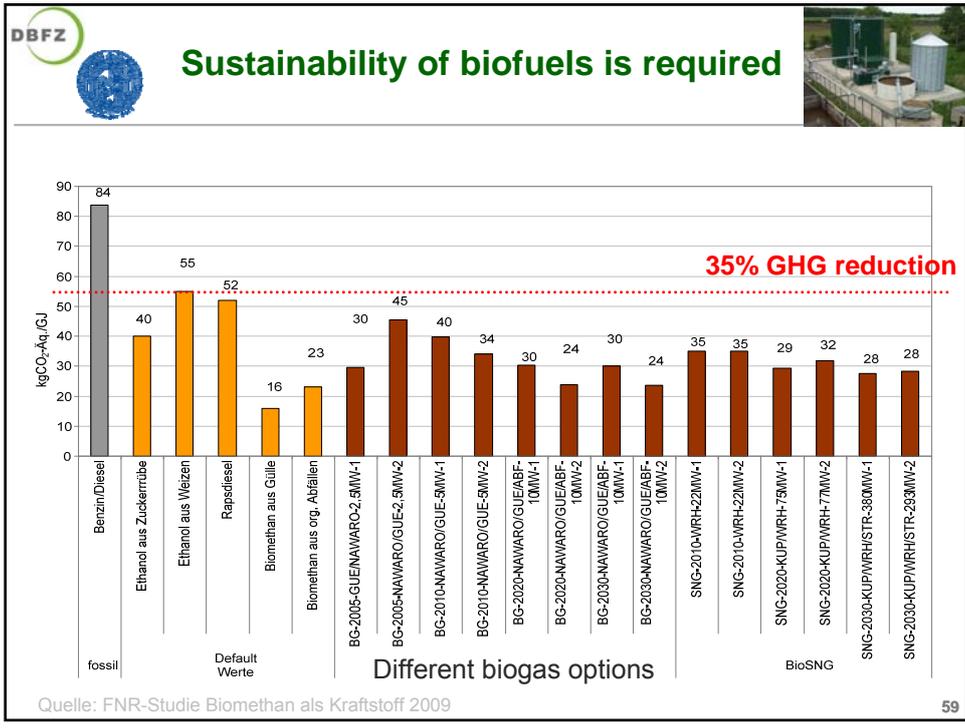


Germany

- 07/2007: more than 62,000 CNG vehicles (overall approx. 46.5 mn vehicles)
- 10/2007: approx. 755 refuelling stations, one biogas refuelling station (overall approx. 14,660 stations)



Source: ENGVA, 2007 / IE Leipzig, 2007





Biomethane: Gas Entry Act



- Priority for renewable gas injection into the national gas grid
 - If free capacities!!
- Clear process for application of gas injection point
 - Time schedules
 - responsibilities
- Defined shares of investment for biogas and grid operator
 - Upgradation: biogas producer
 - Quality and pressure adaption and measurement: 50/50
- Defined tariff for avoided gas grid costs (0,7 ct/kWh)
- Costs for gas grid use ($\geq 0,1$ ct/kWh)
- Defined gas quality requirements (DVGW)
- Technology requirements
- Trading: responsibility is at biogas producer or third party
 - To be balanced within one year

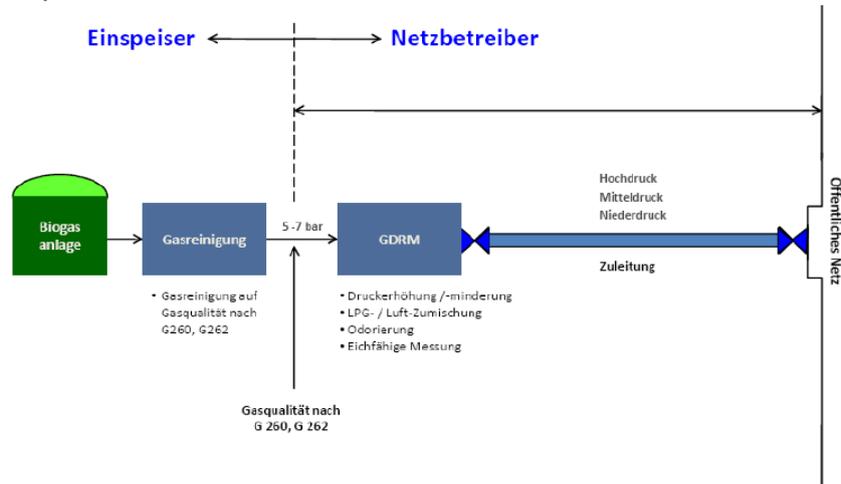
61



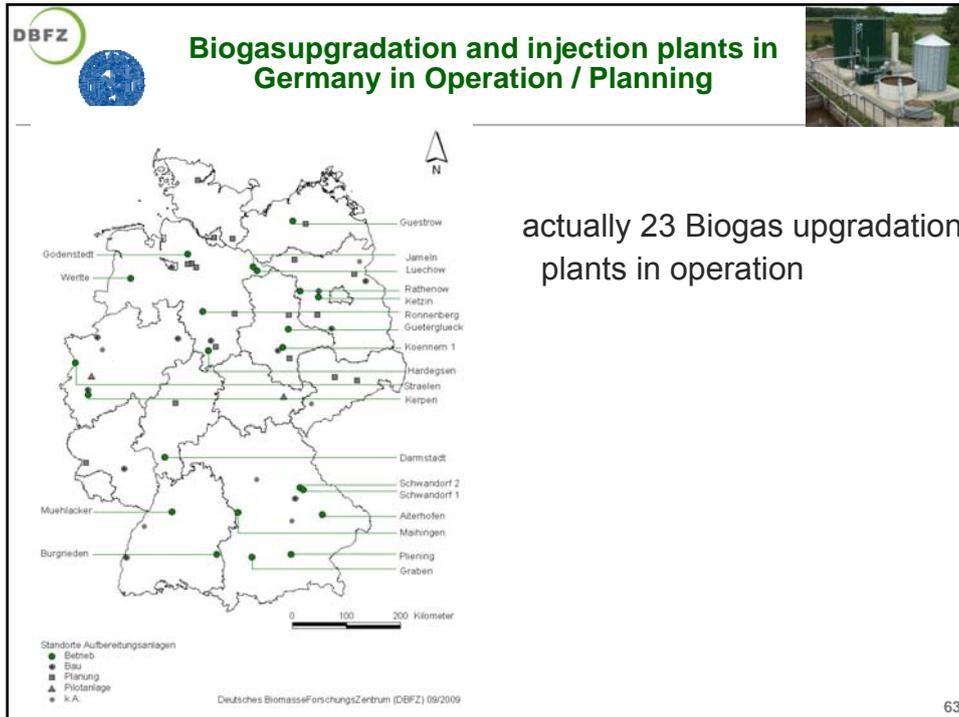
Biomethane: Gas Entry Act



Responsibilities



Darstellung: BMP Green Gas GmbH, München



DBFZ **General enforcement for biogas production and utilization**

- Reduced interest rates for loans for biomass plants, CHP, heat storage vessels, equipment for biogas conditioning
- Kyoto mechanisms
 - Not always to be seen as additive
- Waste management rules (Landfill directives) for (biological-mechanical) pretreatment of waste
- Massive support of applied and basic research
- Market interest in energy from biogas



Summary



- **Strong, effective and complex political support of bioenergy supply, i.e. biogas production and utilization lead to**
 - about 4.000 biogas plants in Germany
 - the situation that Germany is one of the most important technology provider in this sector
 - German research institutions are working very hard for improvements of the biogas process
- **Most important facts for this development:**
 - Reliability of long lasting support measures
 - Clear rules for guaranteed priority feed in of energy from biogas
 - Clear financial rules/tariffs for biogas energy sales

65



References / Sources of information



- WBGU-Report on climate change
 - http://www.wbgu.de/wbgu_jg2007_engl.html
- German Ministry of Environment (Renewable Energy Sources Act, Statistics and other english general information)
 - <http://www.erneuerbare-energien.de/inhalt/3860/>
 - <http://www.erneuerbare-energien.de/inhalt/42934/>
- Federal Agency on renewable biomass supply
 - <http://www.fnr-server.de/cms35/index.php?id=139>
- Export initiative Renewable Energies
 - <http://www.renewables-made-in-germany.com/>

66



DBFZ

**Research for the energy
of tomorrow.**

German Biomass Research Centre
Torgauer Straße 116
D-04347 Leipzig

Contact:
Prof. Dr.-Ing. Frank Scholwin
Frank.Scholwin@dbfz.de

www.dbfz.de
Tel./Fax. +49(0)341 - 2434 – 112 / -133

67